



# The remanufacturing reverse logistics management based on Closed-loop supply chain management processes

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## Abstract

The article explains the definition of closed-loop supply chain and remanufacturing supply chain. This thesis describes the remanufacturing logistics process which based on closed-loop supply chain management. Through analysis of the current remanufacturing supply chain management problem, we proposes some measures of the implementation of remanufacturing supply chain management. It has an important significance on remanufacturing reverse logistics management based on closed-loop supply chain management processes .

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## 1.Introduction

In recent years, more and more attention to environmental protection, as well as concerns optimal allocation of resources, the concept that "low-carbon logistics" has produced with "low-carbon economy" that the international efforts to promote. How to develop "low-carbon logistics", many scholars have put forward their point of view. This paper argues that one of the ways that developing the "low-carbon logistics" is to develop the recycling of waste products remanufacturing supply chain. To solve this problem, many countries have developed regulations that require manufacturers to be responsible for the recycling of waste products, China is also required some electronics manufacturers must be responsible for recycling waste products in 2003. Closed-loop supply chain is different from the traditional supply chain. For the closed-loop supply chain. Looking ahead manufacturing industry prospects to 2020, the U.S. proposed the new ideas that re-manufacturing and waste-free manufacturing, Qiu Ruozhen(2007) summarized closed-loop supply chain network structure in four types: the re-use, remanufacturing, recycling and business returns <sup>[1]</sup>. Closed-loop supply chain is a supply chain system that coexist manufacturing and remanufacturing, in this system, remanufacturing reverse logistics has been called the most complex aspect of manufacturing technology and only use about 50% - 70% of the human and material resources that made used or discarded products back to like new products, or in the functional characteristics and durability for at least the same level with the original product, in 2005, remanufacturing industry output reached 80 billion dollars. China's GDP is expected to reach 4 trillion dollars in 2020, if the level of remanufacturing of the United States in 2002 as a target of China in 2020, the remanufacturing industry output will reach 16 billion dollars <sup>[2]</sup>. it is necessary to research the remanufacturing supply chain.

## 2.Related definition

Closed-Loop Supply Chain(CLSC) as a new logistics term had been put forward in 2003, But there has been no generally accepted definition. This paper argues that the closed-loop supply chain is compared with the traditional supply chain, mainly refers to the entire life cycle of the product, taking into account the forward and reverse supply chain design and management activities, through positive circulation and recovery and remanufacturing of product,

make the traditional open-loop process "resources - Production - Consumption - Waste" into a closed-loop feedback cycle "resource - Production - Consumption - renewable resources". The network structure is shown in Figure 1.

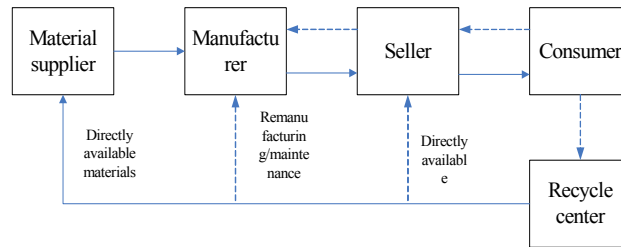


Figure 1 Closed-loop supply chain network structure

There exist a lot of argument about the concept of remanufacturing in closed-loop supply chain, to sum up the main means is a process that waste products through a recycling process to restore the state that may re-use and re-sell. In this process, waste products are recycled, dismantling, testing or replace parts, make some re-use value be re-applications or create "new" products, the "new" products has the performance of original product or higher performance. Remanufacturing is currently mainly used for automobiles, computers, printers, copiers, mobile phones, televisions, refrigerators, air conditioners, washing machines, tires and bulky products such as printed circuit boards.

Management of the process of remanufacturing the uncertainty is the main characteristics of remanufacturing, these characteristics lead to remanufacturing should be distinguished from other forms of production. One of the biggest features of remanufacturing is fully coordinate the two supply system of parts, That is new parts supply system (usually composed by external suppliers) and re-parts supply system (usually composed by the internal storage, dismantling and recovery workshops)<sup>[3]</sup>. Despite the uncertain characteristics of remanufacturing, but the remanufactured products has a significant advantage in the market. Remanufactured product quality and performance not less than new product, compared with the new, lower costs, less the production cycle and the processing time, less adverse effects on the environment were also significantly reduced compared with new products. An example of automobile parts remanufacturing, It is estimated <sup>[2]</sup> that 1 million remanufacturing engine compared to new engine, cost reduce 61%, the production cycle only 46% of the new engine production cycle. Auto parts "remanufacturing" mainly through advanced cleaning, repair and surface treatment technology, make waste components achieve the same performance as new products. This means, if the remanufacturing products can "inherit" 70% of value-added of the old products, only their own material wear compensation 1%~2%, the quality and performance of "Remanufacturing" parts can meet or exceed the new prototype, total cost no more than 50% of new product. Such rapid use of waste, will save 60% of the energy and more than 70% of materials, to achieve the purpose of resource conservation and environmental protection <sup>[4]</sup>. Remanufacturing logistics process can be said to be integrated the upper two reverse logistics model, It is the process from the customers - collectors/sellers - manufacturer - dealer - customer <sup>[5]</sup>.

### 3. The process of remanufacturing supply chain management

Remanufacturing is the process that the waste products back to the "new" state, is an important part in the reverse Logistics, It is an important means and methods to reduction, reuse and recycle, is also a supplementary, its logistics supply chain including the following links: collection, inspection/separation, remanufacturing, redistribution.

- (1) Collection (recovery).
- (2) Detection and evaluation classification, disassembly and cleaning.
- (3) Remanufacturing.
- (4) Redistribution is to sell remanufactured products.

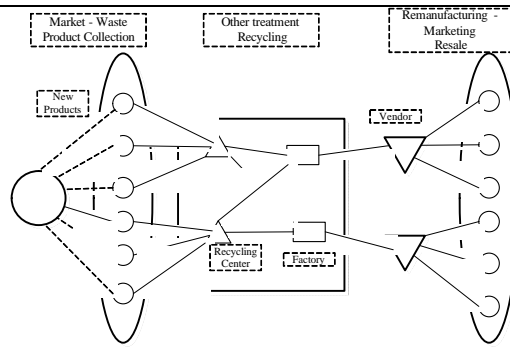


Figure 2 Remanufacturing reverse logistics network

The waste materials that companies collected are stored in the waste warehouse, demolition plant for the remanufacturing demolition process, recoverable parts after the demolition into the recoverable parts warehouse. Parts repair workshop for the restore parts maintenance, rehabilitation and testing, restored good part into qualified parts warehouse, when necessary, new parts were purchased from external suppliers are also stored in this warehouse. On the one hand, to add the shortage of qualified parts, on the other hand, according to the change of the supplier's period in advance and recovery period of maintenance, to make up for production shortfalls; on the assembly line in assembly plant to complete product assembly, assembled products into finished products<sup>[6]</sup>.

As the uncertainty that number of recycled products, time, cost, quality and demand, therefore, remanufacturing reverse logistics can not be controlled the same as the forward logistics, it is also more difficult to Management of its logistics network design, remanufacturing logistics supply chain is much more complex than conventional logistics supply chain.

#### 4. The current main problems of remanufacturing supply chain management

Since the uncertainty of remanufacturing features, remanufacturing enterprises are often faced with remanufacturing planning, inventory and remanufacturing network design and management issues. Therefore it is necessary to analyse the uncertainty of remanufacturing. The uncertainty of remanufacturing management process can be summarized as follows:

- (1) Uncertain amount of waste materials recycling
- (2) Uncertainty of recovery and arrival time
- (3) Uncertain of recycled products quality
- (4) Uncertain demand of manufactured goods
- (5) Uncertainty of remanufacturing cost

Different types, different conditions are mixed with waste materials, resulting in remanufacturing process are quite different, making the uncertainty of remanufacturing cost.

These uncertainties of remanufacturing resulting in complexity of remanufacturing logistics, including production planning, inventory, organizational model, network design management.

#### 5. Strategy of remanufacturing supply chain management

- (1) Build a professional waste products recycling center

Currently, there exist a variety of mixed waste materials recycling center, its main business is only limited to paid or unpaid collection waste goods, most recycling centers do not have the professional category of waste products sector, some recycling centers do only simple treated to recycling waste materials for secondary sales, or simply for storage and then centralize on selling professional recycling centers or directly sold to manufacturers. This gives further difficulty to sales of recovery products, therefore, recycling center as the first node of remanufacturing logistics supply chain not only to be the recycling functions, but also be different from the ordinary recycling center, should have a strong professional, be able to follow the remanufacturing industry standard in accordance with the specification, structure, performance, use of parts to professional cleaning, dismantling, sorting and inventory adjustment for the collected waste products. For large-scale recycling center should be repaired its raw materials. This can speed up the rate of remanufacturing, also saves a professional remanufacturers cost. Professional recycling center should be able to focus on the items recovered, average the imbalance of recovery goods in quantity and quality, should have the advantage of mass transit to reduce the unit cost of shipment.

- (2) Established remanufacturing products network database

Remanufacturing reverse logistics information including recycling, demand and sales volume, inventory levels, shipping status, technical parameters of products and product manufacturing, materials, structure information and so on.

(3) To strengthen cooperation relations, establish and improve the logistics supply chain organization model

Although the remanufacturing logistics supply chain can be operated by a company independently, and also by cooperative enterprises, but now the competition between enterprises has been the development of competition in the supply chain, and the characteristics of remanufacturing supply chain and complexity makes remanufacturing chain have a professional recyclers, producers and sellers, enterprise in the supply chain network should be reached long-term consensus and achieve benefit-sharing, risk sharing, in order to reduce inventory costs, transportation costs, and so on.

companies to gain advantage in competition must be taken to network model in remanufacturing logistics supply chain in the market, and in this

## 6.Conclusion

Face to the limited resources and waste treatment capacity, remanufacturing as an advanced form of recycling has become the focus of attention, and effective and rational management of remanufacturing reverse logistics to give enterprises the potential gains that can Enable enterprises to establish a good image in the community. The article analyzed the current remanufacturing reverse logistics and made some recommendations for their development, but not enough, then the reverse logistics of remanufacturing remains to be further study.

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